

### **REMARKS**

Applicants have thoroughly considered the Office action dated April 3, 2007 and have amended the application to more clearly set forth the invention. Claims 1, 3, 8, 22, 26, and 52-53 have been amended, and claims 23-25, and 51 have been canceled by this Amendment D. New claim 76 has been added. Claims 1, 3, 8, 14-22, 26, 50, 52-58, 62, and 76 are thus presented in the application for further examination. Reconsideration of the application as amended and in view of the following remarks is respectfully requested.

#### **No New Matter**

New claim 76 does not present new matter. The subject matter of claim 76 was previously presented in claim 1, and therefore claim 76 does not present new matter in the present application.

#### **Claim Objections**

Claims 1, 3, 8, 52, and 53 stand objected to because of informalities. Claims 1, 3, 8, 52, and 53 have been amended as suggested by the Examiner in the Office action at page 2.

#### **Claim Rejections under 35 U.S.C. 112**

Claims 1, 3, and 8 stand rejected under 35 U.S.C. 112, first paragraph as failing to comply with the written description requirement. The Examiner asserts that claim 1 implies that each processor associated with any level controls all the levels in the railway system which is new matter in the present application. Claim 1 has been amended to more clearly set forth the invention. Claim 1 as amended states that each processor controls an operation within its associated level and that each processor is responsive to input (i.e., data) from another level to control said operation with the result that the five processors control operation of the railway system across the five levels of the multi-level railway system. This is not new matter (see, for example, claims 1 and 13 as originally presented), and Applicants respectfully request that the Examiner withdraw the rejection of claim 1. Claims 3 and 8 stand rejected for depending on a rejected base claim, and Applicants respectfully request that the Examiner withdraw the rejection of claims 3 and 8 for the same reasons.

Claims 1, 3, 8, 22, and 26 stand rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 1, the Examiner asserts that the requisite degree is not provided to ascertain what all is meant and encompassed by "each processor generating ... parameter data". The referenced section of claim 1 has been amended to recite, "... each processor further generating data and providing the generated data to a processor associated with at least one other level...." "Data" passed between processors at each level is defined throughout the specification of the present application. For example, see paragraph [0039] which states, "It (FIG. 2) illustrates the infrastructure level 100 and the infrastructure level processor 202 interacting with track level 200 and train level 300 to receive input data from these levels, as well as from within the railroad infrastructure level 100 itself, **to generate commands to and/or provide data** to the track network level 200 and the train level 300, and to optimize operation within the railroad infrastructure level 100." Context added. See also paragraph [0045] which states, "FIG. 6 also shows the output of the track network level 200 that includes **data** 526 sent to the infrastructure level, commands 530 to the trains and optimization instructions 528 to the track network level 200 itself." Also, paragraph [0061] states, "The output of the train level includes **data sent** to the infrastructure level 1026 and to the track network level 1028, optimization within the train level 1030 and commands to the consist level 1032." Paragraph [0068] states, "The outputs include **data** 1230 to the train level 300, commands 1234 to the locomotive level 500, and optimization 1232 within the consist level 400." Paragraph [0135] states, "The output from the locomotive level includes **data** 1532 to the consist level and optimization of performance **data** 1534 at the locomotive level." Thus, each level of the multi-level railway system disclosed in the present application teaches generating or aggregating, and sending or providing **data** to at least one other level of the system, and said data is clearly defined throughout the specification in the exemplary paragraphs cited and additional portions of the application. Applicants therefore request that the examiner withdraw the rejection of claim 1. Claims 3 and 8 stand rejected for depending from claim 1, and Applicants also request that the Examiner withdraw the rejections of these claims.

With respect to claim 8, the Examiner asserts that the requisite degree is not provided to ascertain what all is meant and encompassed by "optimization instructions". Claim 8 as

amended does not recite "optimization instructions." Applicants therefore request that the Examiner withdraw the rejection of claim 8.

With respect to claim 22, the Examiner asserts that the phrase "an extent of compliance" is indefinite. Claim 22 as amended recites, "... wherein compliance of the second level with the system optimization parameter...." This is explained, for example, at paragraph [0052] of the present application where the track network level balances fuel costs against delivery schedule compliance. See also paragraph [0010] of the application. Applicants therefore request that the Examiner withdraw the rejection of claim 22.

With respect to claim 26, the Examiner asserts that the phrase "key operating constraints" is indefinite. Claim 26 as amended recites "operating constraints". Operating constraints are explained in the specification in, for example, paragraphs [0009], [0061], and [0069]. Applicants therefore request that the Examiner withdraw the rejection of claim 26.

#### **Claim Rejections under 35 U.S.C. 102**

Claims 1, 3, 8, 14-22, 26, 50, 52-58, and 62 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,828,979 to Polivka et al. (hereinafter Polivka). However, a claim is anticipated only if each and every element as set forth in the claim is disclosed, either expressly or inherently, in a single prior art reference. Verdegal Bros. v. Union Oil. Of California, 814 F.2d 628, 631 (Fed. Cir.1987). Applicants submit that each and every element as set forth in claims 1, 3, 8, 14-22, 26, 50, 52-58, and 62 is not found, either expressly or inherently, in Polivka. Thus, the cited reference does not anticipate the claimed invention.

Polivka discloses a system for controlling the "movement of plural trains through a network of track in a multiple route railway system" (see Polivka at column 1, lines 7-19). The system of Polivka includes a system wide planner, a dispatcher, and an onboard computer on each train to be controlled. The system wide planner determines a coarse schedule which the dispatcher uses to develop a movement plan. The dispatcher directs the movement of trains and track force vehicles (vehicles used by maintenance of way personnel) according to the movement plan by providing a trip plan to each train or track force vehicle and may direct track switches and signals to accommodate the movement plan (see Polivka at Col. 4, Line 39- Col. 5, Line 4).

Polivka fails to disclose controlling a railway system at the infrastructure level, consist level, and locomotive level. That is, Polivka fails to disclose controlling railway equipment

other than track switches, track signals, and vehicles traveling on the tracks. Also, Polivka does not control operations within a train, a consist of a train, or operations within an individual locomotive as a function of the movement plan. Additionally, Polivka does not teach providing data from a train back to the system wide planner. That is, parameters of an individual train or consist are not used to update the coarse schedule. For example, if a locomotive runs out of fuel, that information is not provided to the system wide planner so that the system wide planner can determine a location and method of fueling the locomotive and adapt the schedule to the situation.

In contrast, the present application discloses a system for controlling an operation of a multi-level rail system by exchanging data between each of the various levels of a multi-level railway system. For example, if a locomotive runs out of fuel, the first processor associated with the infrastructure level is informed so that the necessary resources can be allocated (i.e., a technician and repair bay at the appropriate facility), and an appropriate travel route for the locomotive can be determined. Note that the infrastructure level may determine that the locomotive should not be refueled immediately. That is, when looking at the financial constraints, delivery schedules, and fuel depot locations, the first processor may determine that the locomotive should be refueled at a place and time substantially removed from its location at the time of failure. In other circumstances, the system could determine that the locomotive should be refueled immediately at track side by a mobile fuel truck, or at the next station the train arrives at (see Application at paragraphs [0054]-[0057]). Thus, in contrast to Polivka, an embodiment of the present invention controls a function of the railway system as a function of input from multiple levels of the railway system. To this end, claim 1 recites, "...each processor further generating data and providing the generated data to a processor associated with at least one other level, and wherein the processor associated with the at least one other level is responsive to the received generated data to control an operation within the at least one other level such that said first, second, third, fourth and fifth processors control operation of the multi-level railway system across the railroad infrastructure level, the railroad track network level, the train level, the consist level, and the locomotive level of the multi-level railway system as a function of the generated data." To this end, claim 14 recites, "...said first level providing the second level with the first level operational parameters, and the second level providing the first level with the second level operational parameters; and said controlling the operation within the

first level and said controlling the operation within the second level each being a function of the first and second level operational parameters." Claim 50 recites, "...said second level providing the first level with second level operational parameters, and wherein said first level determines the first level operational parameters as a function of the provided second level operational parameters." Accordingly, Polivka fails to anticipate 1, 14, and 50.

The present application also teaches controlling and coordinating infrastructure equipment as a function of input from other levels of the railway system. For example, an infrastructure level 100 of the multi-level railway system refers to, for example, maintenance facilities and service sidings. Infrastructure data includes facility location, facility capabilities (both static characteristics such as the number of service bays, as well as dynamic characteristics, such as the availability of bays, service crews, and spare parts inventory), facility costs (such as hourly rates, downtime requirements), and the earlier noted data such as weather conditions, natural disaster and business objective functions. The infrastructure processor 202 analyzes this input data and optimizes the railroad infrastructure level 100 operation by issuing work orders or other instructions to the service facilities for the particular trains to be serviced, as indicated in block 226, which includes instructions for preparing for the work to be done such as scheduling work bays, work crews, tools, and ordering spare parts. The infrastructure level 100 also provides instructions that are used by the lower level systems. For example, track commands 228 are issued to provide data to revise the train movement plan in view of a service plan, advise the rail yard of the service plan such as reconfiguring the train, and provide substitute power of a replacement locomotive. Train commands 230 are issued to the train level 300 so that particular trains that are to be serviced may have restricted operation or to provide on-site servicing instructions that are a function of the service plan (see Application at paragraph [0039]). To this end claim 1 recites, "... a first processor associated with a railroad infrastructure level configured to control an operation of a railroad infrastructure...each processor further generating data and providing the generated data to a processor associated with at least one other level, and wherein the processor associated with the at least one other level is responsive to the received generated data to control an operation within the at least one other level such that said first, second, third, fourth and fifth processors control operation of the multi-level railway system across the railroad infrastructure level, the railroad track network level, the train level, the consist level, and the locomotive level of the multi-level railway system as a function of the generated data."

The present application also teaches controlling operations within a train as a function of input from other levels of the railway system. The input data at the train level 300, as shown in Fig. 10 and 11, includes infrastructure data 1006, railway track network data 1008, train data 1010, including feedback from the train, and consist level data 1012. The output of the train level includes data sent to the infrastructure level 1026 and to the track network level 1028, optimization within the train level 1030 and commands to the consist level 1032 (see Application at paragraph [0058]). Optimizing performance within the train level 300 includes distributing power to the consists within the train level, distributing dynamic braking loads to the consists levels within the train level and pneumatic braking to the cars within the train level, and wheel adhesion of the consists and railroad cars (see Application at paragraph [0063]). To this end, claim 1 recites, "...a third processor associated with a train level configured to control an operation of a train, wherein the train level is a sub-level of said railroad track network level... each processor further generating data and providing the generated data to a processor associated with at least one other level, and wherein the processor associated with the at least one other level is responsive to the received generated data to control an operation within the at least one other level such that an operation of the railway system is controlled across all the levels of the railway system as a function of the generated data."

The present application further teaches controlling operations within a consist as a function of input from other levels of the railway system. As shown in Fig. 12, the inputs to the consist level, as depicted in the consist level 400 with optimization algorithms, include data 1210 from the train level 300, data 1214 from the locomotive level 500 and data 1212 from the consist level 400. The outputs include data 1230 to the train level 300, commands 1234 to the locomotive level 500, and optimization 1232 within the consist level 400. (See application page 18, paragraph 64). Optimization within the consist considers factors such as fuel efficiency, consumable availability and equipment/subsystem status. For example, if the current demand is for 50% horsepower for the whole consist (prior art consists have all of the locomotives at the same power, here at 50% horsepower for each), it may be more efficient to operate some locomotives at less than a 50% horsepower rating and other locomotives at more than a 50% horsepower rating so that the total power generated by the consist equals the operator demand (see Application at paragraph [0093]). To this end, claim 1 recites, "...a fourth processor associated with a consist level configured to control an operation of a consist of a train, wherein

the consist level is a sub-level of said train level...each processor further generating data and providing the generated data to a processor associated with at least one other level, and wherein the processor associated with the at least one other level is responsive to the received generated data to control an operation within the at least one other level such that said first, second, third, fourth and fifth processors control operation of the multi-level railway system across the railroad infrastructure level, the railroad track network level, the train level, the consist level, and the locomotive level of the multi-level railway system as a function of the generated data."

The present application also teaches controlling operations within a locomotive as a function of input from other levels within the railway system. The input data to the locomotive level includes consist level data 1512 and data 1514 from the locomotive level (including locomotive feedback). The output from the locomotive level includes data 1532 to the consist level and optimization of performance data 1534 at the locomotive level. The data output 1532 to the consist level include locomotive health, friction management, notch setting, and fuel usage, level and range. The locomotive optimization commands 1534 to the locomotive subsystems include engine speed to the engine, engine cooling for the cooling system for the engine, DC link voltage to the inverters, torque commands to the traction motors, and electric power charging and usage from the electric power storage system of hybrid locomotives. (see Application at paragraph [0118]). To this end, claim 1 recites, "...a fifth processor associated with a locomotive level configured to control an operation of a locomotive, wherein the locomotive level is a sub-level of said consist level...each processor further generating data and providing the generated data to a processor associated with at least one other level, and wherein the processor associated with the at least one other level is responsive to the received generated data to control an operation within the at least one other level such that said first, second, third, fourth and fifth processors control operation of the multi-level railway system across the railroad infrastructure level, the railroad track network level, the train level, the consist level, and the locomotive level of the multi-level railway system as a function of the generated data."

### CONCLUSION

As amended, applicants submit that claims are distinguishable from the prior art both in terms of functions and structure. As described above the structure of system disclosed in Polivka does not include processors associated with each of the various levels of a railway system nor does it disclose that each processor level interacts with other levels, with different data being interchanged at each interface between the levels so that the levels can cooperate to control an operation of the overall railway system.

In view of the foregoing, applicants submit that amended claims 1, 14, and 50 are allowable over the cited art. The remaining dependent claims are believed to be allowable for at least the same reasons as the independent claims from which they depend.

It is felt that a full and complete response has been made to the Office action, and applicants respectfully submit that pending claims 1, 3, 8, 14-22, 26, 50, 52-58, 62, and 76 are allowable over the cited art and that the subject application is now in condition for allowance.

The fact that applicants may not have specifically traversed any particular assertion by the Office should not be construed as indicating applicant's agreement therewith.

The Commissioner is hereby authorized to charge \$120.00 to cover the fee for a one-month extension of time up to and including today's date, or charge any underpayment to Deposit Account No. 07-0846.

Respectfully submitted,

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